Polymeric Medical Sutures

Ming Yu, Debbie Schneiderman, Jane Wissinger, , Lindsay Davis
University of Minnesota-Twin Cities, Chemistry Department

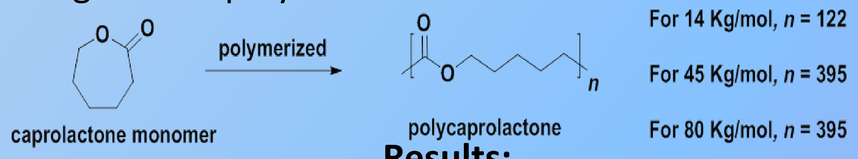
Introduction

Have you ever had medical sutures or seen them used, for example for a deep cut, knee surgery, or wisdom tooth extraction? Did they have to be cut out after the wound healed or were they "dissolvable/absorbable"? Regardless, all medical sutures are made of materials called polymers, which is the topic of this experiment. The experiment consists of three parts: drawing the suture, strength and knotability test, and the degradable test.

Sutures are rows of stitches that hold together two sides of a surgical incision or wound that is too large to mend on its own. Organic polymers are the substances that make up the sutures. There are many types of suture materials, including natural and synthetic material. The sutures property is also determined by the material, whether it can or cannot be absorbed by the human body, and whether it is braided or consists of a single strand.

Drawing Sutures

- Drawing sutures from caprolactone
- Investigation of polymer size and suture characteristics



Results:

- The 80K needs more heat to melt than 14K and 45K
- All the polymers turned clear while heating.
- The 14K polymer has the highest viscosity as melted.
- 80K pulled the strongest and longest sutures
- 45K variable
- 14K didn't allow to pull

Improvements to the Experiment

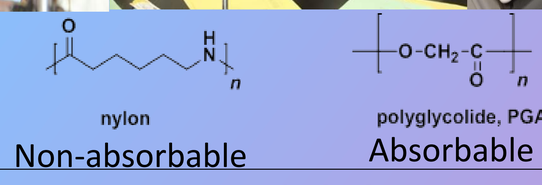
- **Use of glass stir rod instead of pipette (reusable, therefore less waste and more economical)**
- **Hand-made weight boats (more economical and less polymer required)**

Strength and Knotablility of Sutures

- Tensile test applied
- Material: Gauge 4-0 and 5-0 Nylon, PGA and RPGA sutures from ADS medical suture
- Compare with "homemade" caprolactone sutures

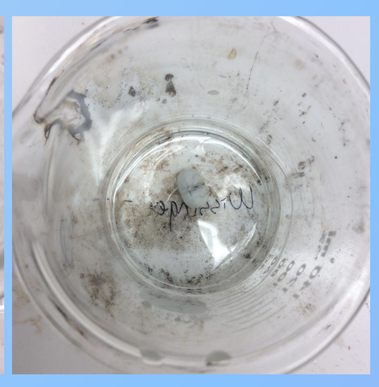
Result:

- Smaller Gauge → Thicker Thread → Stronger Suture
- Both Non-absorbable and Absorbable sutures have same strength for same gauge
- Homemade sutures are to brittle



Non-absorbable Absorbable

Degradability Test			
	Degradability?	Second Surgery?	Where to use?
Absorbable Sutures	Dissolved and digested	NO	Internal Surgery
Non-absorbable Sutures	Not dissolved	Yes	External Cuts and Incisions



Improvement

- **Ethanol was removed from the solution prepared to dissolved the suture.**

Results				
material	PGA	RPGA	Nylon	Homemade
Dissolved?	YES	YES Fastest!	NO (>15min)	YES

Summary

- Investigated polymer experiment based on medical sutures
- Successfully carried out last summer with a 25 member group
- Followed the green chemistry guidelines
- Lowered the cost to be more approachable for Twin-Cities area high schools

Acknowledgement

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